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Interactive comment on “Turbulent transport, emissions, and the role of compensating errors in chemical transport models” by P. A. Makar et al.

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Makar et al. have performed a detailed comparison of CMAQ and AURAMS O₃ and PM_{2.5} simulations that were made for a small regional domain of Canada and the United States that included Vancouver. This is an excellent study and there are several key points that include the following.

Their comparison of O₃ and PM_{2.5} time series data from Vancouver with CMAQ and AURAMS simulations is very interesting. I would have expected that model simulated O₃ concentrations to show less diurnal variability than observations. However Makar et al. found the opposite result. There is much greater variability in the simulated O₃ and PM_{2.5}. AURAMS could fit well the lowest O₃ mixing ratios but it over predicted the peak O₃ mixing ratios. CMAQ did not fit the O₃ mixing ratio peaks or the O₃ nighttime

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lows. AURAMS rather drastically overestimated PM2.5 concentrations.

Makar et al. performed a number of sensitivity tests to evaluate the relation between turbulent transport and emissions to better understand their effects on O3 and PM2.5 simulations. A key finding is that there can be conflicts between better simulations of O3 and better simulations of PM2.5. The choice of the priori cut-off of the lower limit in the magnitude of vertical diffusion coefficients was one such conflicting parameter.

Another key finding is that detailed comparisons between simulations and observations are limited by the non-availability of episode specific time-resolved emissions of O3 precursors and PM2.5. This data would be highly desirable for future comprehensive field studies for model evaluation and development.

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